

gas distribution plate for use in a plasma processing apparatus” while claim 35 recites “A method of improving the performance of a gas distribution plate for use in a semiconductor fabrication apparatus”. Applicants respectfully submit groups II and III should be considered in a single application and would not impose an undue searching burden on the Examiner.

Claims 1-18 have been rejected by the Examiner. Such rejections are fully traversed below. Claims 1, 2 and 5 have been amended. Claims 38 and 39 have been added. Claims 1-18 and 38-39 are thus pending in this Application.

Rejections Under 35 U.S.C. § 112, second paragraph

Claims 1-18 were rejected to under 35 U.S.C. 112, second paragraph, as being indefinite and for failing to particularly point out and distinctly claim the invention. Claims 1 and 5 have been amended to further clarify the subject matter regarded as the invention in accordance with the Examiner’s comments. Applicants note that the terms “consistent reactivity” and “constant reactivity” are not used in independent claim 12. As per the meaning of “substantially non-reactive” in claim 12, the term is supported by the Specification, for example, on page 6, lines 22 to page 7, line 17, and page 9, line 1-13. Accordingly, Applicants respectfully submit that all pending claims are sufficiently clear and definite and thus respectfully request withdrawal of the rejection under 35 U.S.C. § 112, second paragraph.

Rejections Under 35 U.S.C. § 102(b)

Claims 1, 9 and 11-13 stand rejected under 35 U.S.C. §102(b) as being unpatentable over Foster et al., U.S. Patent No. 5,273,588 (“Foster”). Applicants respectfully disagree.

As mentioned on page 3, line 18 to page 4, line 2, the invention relates, in one aspect, to a gas distribution plate (GDP) for use in a semiconductor fabrication apparatus, upon construction or as a replacement, without compromising semiconductor fabrication apparatus performance over the operational lifetime of the GDP. The GDP is pretreated before implementation in the semiconductor fabrication apparatus. The pre-treatment acts to minimize, and potentially eliminate, micro-defects which may react with process chemistry used in the semiconductor fabrication apparatus. The pre-treatment is applied to at least a portion of the gas distribution plate.

Foster is concerned with chemical vapor deposition (CVD) processes that are amenable to enhancement by wafer movement (Column 3, lines 20-22).

Correspondingly, Foster teaches a CVD processing apparatus with a reactor having a single wafer rotating susceptor on which a wafer is maintained at a processing temperature and gases are flowed to cause a thin boundary layer above the wafer surface to allow diffusion of process gases. Gases are flowed with minimum turbulence from a downwardly facing showerhead and radially across the wafer. Structures within the CVD processing apparatus are shaped to facilitate this non-turbulent gas-flow. For example, the walls of the susceptor have finishes and cross-sections that retard the flow of heat from the heated components to the cooled components of the reactor (Column 4, lines 18-55).

As Foster is concerned with non-turbulent gas flow within the reactor, he does not teach or remotely suggest a gas distribution plate comprising “a portion being substantially non-reactive to the process chemistry used in the semiconductor fabrication apparatus over the entire operating life of the gas distribution plate” as recited in independent claims 1 and 12. The limited teaching of Foster towards a gas distribution plate (or showerhead 35) does not teach chemical reactivity. In contrast, the showerhead 35 of Foster is adapted to facilitate non-turbulent gas flow. More specifically, Foster states the showerhead 35 “has a highly polished lower surface to retard the absorption of radiant heat from the higher reaction temperature from the area of a wafer being processed in the chamber”. In other words, the showerhead 35 is adapted to facilitate flow downwardly toward the wafer. As one of skill in the art will appreciate, polishing a surface to facilitate fluid flow does not anticipate any level of chemical non-reactivity, nor does it suggest protecting a wafer from gas distribution plate composition, and the Applicants respectfully submit that chemical reactivity or non-reactivity of any level is not inherent in a processing apparatus designed for non-turbulent gas flow.

Withdrawal of the rejection of claims 1, 9 and 11-13 based on 35 U.S.C. § 102(b) is therefore respectfully requested.

Claims 1 and 9-13 stand rejected under 35 U.S.C. §102(e) as being unpatentable over Zhao et al., U.S. Patent No. 5,994,678 (“Zhao”). Applicants respectfully disagree.

Zhao provides systems, methods and apparatus for depositing titanium films at high rates on semiconductor substrates. A deposition system is provided that incorporates a flow restrictor ring, a thermal choke, a ceramic heater and other features that allow high flow rates through the chamber with minimal backside deposition on the bottom of the chamber.

The Office Action states that Zhao's processing chamber is for high temperatures and corrosive environments (Column 22, lines 25-30). However, Column 22, lines 25-30 refers to a ceramic heater assembly and not a processing chamber. Regardless, the Office Action further states that the "shape of the ceramic component can be modified by grinding and drilling (Column 22, lines 25-30)". As one of skill in the art will appreciate, grinding and drilling may include varying levels of material removal, many of which may lead to surface and particle defects associated with conventional gas distribution plates that may compromise wafer quality as described in the Background of the Specification on page 2. Zhao does not teach or remotely suggest wafer compromise as a result of gas distribution plate composition. Thus, grinding and drilling per se, as briefly mentioned by Zhao, may lead to problems described in the Background of the Specification and do not anticipate the present invention. More importantly, grinding and drilling cannot be extended to suggest a gas distribution plate comprising "a portion being substantially non-reactive to the process chemistry used in the semiconductor fabrication apparatus over the entire operating life of the gas distribution plate" as recited in independent claims 1 and 12. In addition, as grinding and drilling may include varying levels of material removal, many of which may lead to compromised wafer quality as described, the teachings of Zhao do not inherently anticipate the present invention as suggested by the Office Action.

Withdrawal of the rejection of claims 1, 9 and 11-13 based on 35 U.S.C. § 102(b) is therefore respectfully requested.

Rejections Under 35 U.S.C. § 103

Claim 14 stands rejected under 35 U.S.C. §103 as being unpatentable over Foster et al., U.S. Patent No. 5,273,588 ("Foster") in view of Zhao et al., U.S. Patent No. 5,994,678 ("Zhao"). Claims 2-8 and 15-18 stand rejected under 35 U.S.C. §103 as being unpatentable over Foster et al., U.S. Patent No. 5,273,588 ("Foster") in view of Goldstein et al., U.S. Patent No. 5,494,439 ("Goldstein"). Applicants respectfully disagree.

Dependent claims 2-11, 13-18, and 38-39 each depend either directly or indirectly from independent claims 1 and 12 and, therefore, are respectfully submitted to be patentable over any combination of Zhao, Foster and Goldstein for at least the same reasons set forth above with respect to the independent claims. Applicants further respectfully submit that the teachings of Goldstein fail to cure the deficiencies of Zhao or Foster with respect to the independent claims. Further, the dependent claims require additional elements that when considered in context of the claimed

inventions further patentably distinguish the inventions from the art of record. By way of example, dependent claim 2 recites "the portion of the gas distribution plate is rendered substantially non-reactive by reducing surface defects on the portion before implementation within the semiconductor fabrication apparatus". Applicants respectfully submit that the art of record does not teach this limitation.

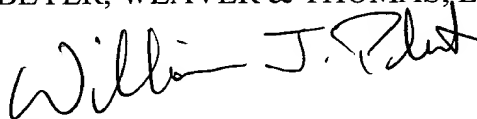
Withdrawal of the rejection of claims 2-8 and 14-18 based on 35 U.S.C. § 103 is therefore respectfully requested.

SUMMARY

In view of the foregoing, Applicants believe that all pending claims are allowable and respectfully requests a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

No fees are believed due in connection with the filing of this paper. However, if any fees are due in connection with the filing of this paper the Commissioner is authorized to charge such fees to Deposit Account 50-0388 (Order No. LAM1P118).

Respectfully submitted,
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Limited Recognition under 37 C.F.R. §10.9(b)

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